LEAD IN ARIZONA:
POLLUTION PREVENTION OPPORTUNITIES

Prepared by the Arizona Department of Environmental Quality: Pollution Prevention Unit.
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BACKGROUND

Lead, an odorless, bluish-grey, heavy metal, has been around civilization since ancient times. It is a major component of many alloys, such as bronze and solder. The environmental and health affects of lead are numerous and well documented.

There are many sources of lead in the environment in both residential and industrial settings. Since most lead prevention programs and efforts are targeted at preventing residential exposures, this report focuses mainly on preventing lead releases and exposures in an industrial setting. However, a brief synopsis of the residential efforts is also included along with contacts for more information.

This report is the result of a grant, in 1995, to the Arizona Department of Environmental Quality (ADEQ), Pollution Prevention Unit from the U.S. Environmental Protection Agency. The main focus of the grant was to provide Toxic Chemical Release Inventory Report (TRI) assistance and to analyze Arizona's Pollution Prevention Plans and TRI results in relation to lead in the Arizona environment and to develop ways for industries to prevent lead releases.

The objective of pollution prevention (P2) planning is to reduce the use of toxic substances at the source, minimize the generation of hazardous wastes and prevent the release of pollutants to the environment. P2 activities include toxics use reduction, source reduction, recycling, waste minimization, reuse, reclamation, conservation, and substitution.

Pollution prevention provides improved environmental protection, lower waste handling treatment and disposal costs, raw material and energy conservation savings, reduced liability, a safer and cleaner work place, and improved regulatory compliance. Lead poisoning can be prevented through pollution prevention activities.

Part 1. THE PROBLEMS:

Lead is toxic to humans of all ages through ingestion and inhalation. Children are more susceptible because they still have developing nervous systems and are often exposed during normal play activities.

Lead adversely affects numerous body systems and causes forms of health impairment and disease that arise after periods of exposure as short as days or as long as several years. High blood-lead levels can cause permanent nervous system damage. However, even low levels of blood-lead have been shown to cause a reduction in intelligence and attention span, reading and learning disabilities and behavior problems.

The most common source of lead poisoning is the ingestion of lead-contaminated surface dusts. This dust is usually contaminated from lead-based paint that is deteriorating (from chipping or peeling) or from repainting or remodeling projects. The second most common form of lead poisoning is from

bare lead contaminated soil. The soil is usually contaminated from leaded gasoline, deteriorating exterior paint or industrial sources. Less common forms of lead poisoning include drinking water, ceramics containing lead glaze, old toys or furniture with lead-based paint, parent's work clothes and several folk remedies.

New sources of lead contamination are being identified all the time. Recently, the Arizona Department of Health Services (ADHS) discovered that some types of miniblinds contain dangerous levels of lead. The affected blinds either have been labeled as imported or have contained no identification as to the manufacturer or country of production. This warning followed a similar warning by ADHS on the discovery of lead in crayons imported from China.

It is estimated that 1.7 million children (about 9% of all children in the U.S.) have blood-lead levels above the Centers for Disease Control's "level of concern." In recent years, the number of children with elevated blood-lead levels has been decreasing due mainly to removing lead from gasoline and food cans and the ban of lead-based paint.

Even though lead-based paint was banned in 1978, it is still estimated that approximately 57 million pre-1978 housing units still contain some lead-based paint. An estimated 13.8 million housing units contain deteriorating lead-based paint with about 6 million in very poor condition. Older neighborhoods and urban cities have a more severe problem. Also, children living in poverty are four times more likely to have elevated blood-lead levels that wealthier children. African-American children are also four times more likely to have elevated blood-lead levels that white children. All of these issues combine to make prevention an even more critical factor to the health of the nation's children.

(Source : Lead-Based Paint Hazard Reduction and Financing Task Force - Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing.)

Air Quality in Arizona

Substantial decreases in lead concentrations in air emissions in Phoenix and Tucson were monitored by the Arizona Department of Environmental Quality (ADEQ) from 1985 through 1989. Lead levels in both cities have remained at 0.05 µg/m3 and 0.10 µg/m3 respectively. These are well below the air quality standard of 1.5 µg/m3 for the maximum quarterly average. Prior to 1985, lead concentrations in air emissions also declined each year as a result of reduced lead emissions from motor vehicles. (Source: ADEQ 1994 Air Quality Data for Arizona EQR 95-2.)

Toxic Chemical Release Inventory Report

Submission of the EPA Form R, the Toxic Chemical Release Inventory Reporting Form, is required by section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA, or Title III of the Superfund Amendments and Reauthorization Act of 1986), Public Law 99-499.

Reporting is required to provide the public with information on releases of listed toxic chemicals in their communities and to provide EPA and the State of Arizona with release information to assist in targeting future efforts. Facilities must report the quantities of both routine and accidental releases of listed toxic chemicals, as well as the maximum amount of the listed toxic chemical on site during the calendar year and the amount contained in wastes transferred off-site.

A completed Form R must be submitted for each toxic chemical manufactured, processed, or

otherwise used at each covered facility that exceeds the respective threshold. Lead and lead compounds are listed toxic chemicals. The report for any calender year must be submitted on or before July 1 of the following year to the EPA, the Arizona Department of Environmental Quality and the Arizona Emergency Response Commission.

ADEQ enters Arizona's TRI reports into a database and compiles the "Toxic Chemical Release Inventory Report Summary" for distribution. This Summary is a comprehensive compilation of the TRI data for Arizona that summarizes releases to the environment and wastes managed for Arizona facilities. Annual trends are given as well as the names of facilities that released the greatest amounts of toxic chemicals in Arizona. For calendar year 1994, Arizona had 199 facilities submit 522 forms.

The facilities listed in Table 1 are those facilities in Arizona that reported lead or lead compounds on a Form R at least once between 1991 and 1994 to ADEQ. The number of Form R filers for lead has been steady, but small, for the past four years.

Form R filers for Lead/Lead Compounds

1991: 11 Facilities
1992: 12 Facilities
1993: 11 Facilities
1994: 13 Facilities

Table 1. Form R Filers, 1991-1994.

Facility	***Year Filed***	***City***
AACCO Cast Products	94	Hayden
Asarco - Ray Complex	91,92,93,94	Hayden
Arizona Galvanizing	94	Goodyear
Cable Systems International	91,92,93,94	Phoenix
Cyprus Bagdad Copper	92,93	Bagdad
Cyprus Miami Mining	91,92,93,94	Claypool
Continental Circuits	91,92,93,94	Phoenix
Gilbert Engineering	91,92,93,94	Glendale
General Cable Company	91,92,93,94	Kingman
Go/Dan Industries	91,92	Phoenix
Gould Electronics	93,94	Bensen
Magma Metals	91,92,93,94	San Manuel
Motorola - CPSTG	91	Phoenix
Triangle Wire and Cable	92,94	Glendale
Tucson Foundry	91,92,93,94	Tucson
World Resources	91,92,93,94	Phoenix

In Arizona, lead compounds (category N420) and lead (CAS #7439-92-1) were ranked in the top ten chemicals released to air and land for the smelting industry only in 1994. Lead and lead compounds were not significant releases for other industries. For non-smelting facilities, there were no land releases of lead or lead compounds, but 17 pounds of lead compounds and 759 pounds of lead were released to the air. Three facilities released the lead compounds and two facilities released the lead to the air.

The smelting industry in Arizona released 41,414 pounds of lead compounds and 11,000 pounds of lead to the air. The smelting industry also released 2,688,200 pounds of lead compounds and 1,000 pounds of lead to land. Two smelters, Asarco Hayden and Cyprus Miami, were responsible for 99.99% of the releases of lead compounds to the air and land (Table 2). Magma Metals was responsible for all of the 11,000 pounds of lead released to the air and the 1,000 pounds of lead released to the land.

Table 2. Releases of Lead Compounds to Air and Land (Form R-Section 5).

Facility	***Released to air Pounds***	***Released to land Pounds***	***Total Pounds***
Asarco - Ray-Hayden Smelter	24,014	1,864,200	1,888,214 - 69%
Cyprus Miami Mining Corp.	17,400	824,000	841,400 - 31%
Non-Smelters	17	0	17
Totals	41,431	2,688,200	2,729,631

Lead and lead compounds were sent off-site for recycling and for disposal by non-smelting facilities. These facilities sent off-site for recycling 160,176 pounds of lead and 98,982 pounds of lead compounds. They also sent 4,683 pounds of lead compounds for off-site disposal (Table 3).

Table 3. Disposition of Lead and Lead Compounds from All Non-Smelting Facilities.

	Total for all chemicals at all facilities. Pounds	**Total for all chemicals at Non-Smelters. *Pounds***	**Lead Compounds *Pounds***	**Lead *Pounds***
Recycled	41,057,949	31,042,631	98,982	160,176
Off-site Treated	2,521,226	1,104,404	5,990	275
Off-site Disposal	281,983	280,983	4,683	0

Only 6 facilities in Arizona were responsible for the majority of lead and lead compounds recycled off-site and treated off-site (Table 4). From this information, it could be concluded that lead and lead compounds are not reportedly a wide-spread industrial reported release. This conclusion could be incorrect if many facilities fail to file a Form R for lead or lead compounds or if many facilities do not meet the thresholds for Form R filing. There is no practical way to estimate, based on the Form R, the amount of lead or lead compounds actually released to the environment in Arizona.

Table 4. Major Facilities Responsible for Off-site Recycling, Treatment and Disposal of Lead (L) and Lead Compounds (LC).

	Off-Site Recycling		***Off-Site Treatment***	
Facility	***Pounds***		***Pounds***	
Gilbert Engineering	112,000 (L)	70%	35 (L)	13%
Cable Systems International	63,700 (LC)	64%		
Continental Circuits	44,000 (L)	27%	39 (L)	14%
General Cable Corporation	2,460 (LC)	2.5%	5,990 (LC)	100%
Tucson Foundry	3,551 (L)	2.2%	201 (L)	73%
Gould Electronics	31,422 (LC)	32%		
Total	98,982 (LC)		5,990 (LC)	
	160,176 (L)		275 (L)	

On the other hand, smelters are large reporters of lead and lead compounds due to the nature and size of their operations, but they are also isolated away from urbanized areas. The smelters have strict regulations and oversight by ADEQ. The smelting industry sent 1,110,465 pounds of lead compounds and 750 pounds of lead for off-site recycling and 11,709 pounds of lead compounds for off-site treatment (Table 5).

Table 5. Disposition of Lead and Lead Compounds from Smelters.

	Total for all chemicals at all facilities. Pounds	***Total for all chemicals at Smelters. Pounds***	***Lead Compounds Pounds***	***Lead Pounds***
Recycled On-site	497,618,868	not calculated	4,848,648	160,176
Recycled Off-site	41,057,949	10,015,318	1,110,465	750
Treated Off-site	2,521,226	1,416,822	11,709	0
Disposal	281,983	1,000	0	0

Asarco - Ray - Hayden Smelter and Cyprus Miami were the only two smelters that recycled, treated and disposed of lead compounds. Magma Metals accounts for 100% of the lead that was recycled on and off-site by smelters (Table 6).

Table 6. Smelters Responsible for Off-site/On-site Recycling and Treatment of Lead Compounds.

Facility	***Off-site Recycling Pounds***	***On-Site Recycling Pounds***	***Off-site Treatment Pounds***
Asarco Ray Hayden Smelter	1,073,465 - 97%	4,636,648 - 96%	11,709 - 100%
Cyprus Miami	37,000 - 3%	212,000 - 4%	0
All Smelters	1,110,465	4,848,648	11,709

The TRI data presents some interesting information about lead and lead compounds in Arizona. When comparing total numbers, lead and lead compounds appear at the top of many of the lists and yet when examined closer, it becomes obvious that it is not a widespread reported industrial release in Arizona. The majority of lead releases, recycling and treatment are due solely to two smelters. These two smelters overshadow any other industrial releases throughout the State.

Other sources of lead seem to be more critical, especially residential exposures.

Part 2. THE ANSWER: Pollution Prevention

Pollution prevention planning is required by Arizona statute for various facilities to reduce the amount of wastes generated and toxic substances used in order to reduce risk to public health, safety, welfare and the environment. The Pollution Prevention Unit (PPU) at ADEQ reviews Plans for acceptance. The Plan documents that the facility has performed a rigorous pollution prevention/ waste minimization assessment.

Overall, the Plan must include a management commitment to pollution prevention, an evaluation of potential pollution prevention opportunities, and a timetable for implementing selected pollution prevention measures. This Plan must address opportunities for reduction of toxic substance usage, reduction of hazardous waste generation, and releases of pollutants to all environmental media (land, air and water). In addition, other pollution prevention activities may also be included within the Plan that address solid waste, energy conservation, or water conservation.

Pollution Prevention Plans are an excellent source of information on numerous pollution prevention activities throughout Arizona. Facilities must submit annual progress reports outlining their progress towards achieving the goals they developed in their Plan. These progress reports are analyzed and entered into a database which enables quick searches to be conducted based upon chemical name, CAS number, facility name, geographic location or other criteria. These Plans can be reviewed at the ADEQ-Pollution Prevention Unit or by calling (602) 207-4235.

Specific Industrial Opportunities
The following information was gathered from facilities in Arizona that submitted Pollution Prevention Plans to ADEQ-PPU with a goal related to lead.

Arizona Plating and Anodizing
Goal: Reduce pollutants (Lead, chromium, cadmium, copper, nickel, zinc, silver) released to

POTW through rinsewater.
Method: Establish written rinsing sequences for the steel and aluminum plating lines.

Asarco Mission Complex
Goal: Eliminate the use of Lead based thread compounds.
Method: Substitute with zinc based thread compounds. Reduced 388 lbs.

Avanti Circuits
Goal: Reduce generation of recyclable solder stripper waste for tin/lead plating removal from circuit boards.
Method: Process Modification; use frequent analysis and addition of hydrogen peroxide to change saturation point to 67.5 gm/l from 39 gm/l. Reduced 385 gallons.

Capital Castings dba Magotteaux
Goal: Reduce the generation of electric arc furnace fume dust which will lead to reduced hazardous waste disposal.
Method: Install a lime and soda ash injection system to increase the pH of fume dust and add cement to the dust to stabilize the dust (prevent leaching) prior to disposal. Reduced 1,007,812 lbs.

ESH Inc.
Goal: Eliminate the tin/lead 10% fluoboric acid dip and hydrochloric acid used in the solder plate process.
Method: Eliminate solder plate process and send any solder request to an outside source; provide a gold plated board. Reduced 2,009 lbs.

U.S.A.F. - Hughes Aircraft
Goal: Investigate lead-free solder alternatives by working with National Center for Manufacturing Sciences.
Method: Qualify a less hazardous solder alloy to replace the lead based alloys now in use. Try tin/bismuth developed by IBM.

Litton Systems
Goal: Reduction of solid wastes by 25% in the cadmium and lead powder processes.
Method: Replace lead powder to make metal glass seals by using solid preform washers. Reduced 960 pounds.

U.S.A.F. - Luke
Goal: Reduce waste generated as used batteries (lead acid, nickel/cadmium and mercury).
Method: Implement contracts for battery recycling of "wet" lead acid batteries. Reduced 1,335 lbs.

Goal: Armament Shop - minimize hazardous waste (lead contaminated water) generated from cleaning small weapons.
Method: Purchase and install an enclosed hot water jet washer to replace the aqueous detergent (XRT-5) in the cleaning tank. Reduced 1,350 gallons.

Goal: Reduce generation at the small arms firing range (lead contaminated sand).
Method: Install cazwell backstop to collect spent shot and eliminate contaminated sand. Reduced 103,866 pounds.

Motorola - Logic and Analog

Goal: Reduce photoresist waste in application process.

Method: Replace existing pumps with IDI pumps which dispense more precisely. Reduced 3,100 gal.

Motorola Computer Group (Diablo Way)

Goal: Reduce generation of wave solder dross by 15%

Method: Retrofit solder equipment with a nitrogen purge system to reduce dross generation. Reduced 10,260 pounds.

Goal: Evaluate alternative methods of disposal for the lead-containing debris wastestream to replace incineration.

Method: Send lead-containing waste stream to a precious metal reclaim facility.

Motorola - GSTG - Chandler

Goal: Reduce characteristic lead bearing waste (D008).

Method: Process modifications; design for environment training; product modifications; IR reflow; solder mask over bare copper; increased integration.

Southwest Circuits

Goal: Eliminate all circuit board scrap being landfilled.

Method: Implement administrative controls to provide for reductions; search for a recycler; recycle if vendor found.

Goal: Reduce the use of solder leveling "reflow" fluid in circuit board manufacturing and the resultant hazardous waste.

Method: Use method of draining only half of the spent reflow fluid and replacing half with new fluid; SPC implementation has also aided efforts. Reduced 275 gallons.

Goal: Reduce the number of circuit boards scrapped due to bad film resulting from lack of a climate control system in the artwork image room.

Method: Build a climate control system in the artwork image room.

Tucson Foundry and Mfg.

Goal: Reduce the amount of lead dust formed during cutting and cleaning of castings.

Method: Cutting - flooding machines keeps air-borne lead down 80%. Cleaning Room - install airwalls; filter air 3 times to achieve 95% reductions.

Goal: Improve dust capture throughout the building.

Method: Install a portable bronze chip vacuum to keep lead from getting airborne when cleaning floors.

Goal: Reduce emissions of fugitive lead fumes from furnaces and pouring ladle.

Method: Double dust collector capacity: Cover furnace and ladle with vacuum system; modify the fume collection system with new ducts and collectors.

United Musical Instruments

Goal: Eliminate the lead slag volumes generated in the drawing and forming process.

Method: Rinse the lead doughnuts prior to heating to reduce the amount of lead slag.

Goal: Reduce the discharge of lead.

Method: Implement effective management system; determine baseline lead discharge volumes; monitor and control inventory.

Van Waters & Rogers

Goal: Corrosive drum rinsing - reduce generation from rinsing returned drums of corrosive liquids.

Method: Install a wastewater pretreatment system and filter press to dewater sludge. Reduced 11,904 pounds.

General Opportunities

- Remove all lead based paint or use a permanent barrier to eliminate chips.
- Use lead-free solder and plumbing fixtures.
- Use lead-free paint on all products.
- Recycle all lead acid batteries.
- Clean up paint chips immediately.
- Thoroughly rinse sponges and mop heads after cleaning dirty or dusty areas.
- If you work with lead, shower and change clothes before going home. Launder your clothes separately from the rest of the family's.
- Don't use a belt sander, propane torch, dry scrapper or dry sandpaper on painted surfaces that may contain lead.

Residential Opportunities

- Use lead-free paint.
- Test water, soil and paint if lead suspected.
- Do not let children eat dirt or food that has fallen on the ground or floor.
- Keep your home as dust free and clean as possible. Wipe floor and window sills with a high phosphate soap, such as automatic dishwasher detergent or "TSP."
- Keep children from chewing window sills or other painted surfaces.
- To protect your family, have home repairs and renovations done by workers trained in lead abatement.
- Ask your doctor for a blood-lead level check.

Part 3. ADDITIONAL RESOURCES

Pollution Prevention for Mining Facilities

The ADEQ Pollution Prevention Unit completed a document titled "Arizona Mining Heavy Equipment and Fleet Maintenance: Pollution Prevention Practices and Opportunities." The document addresses lead contaminated filters, coolant, batteries, and lubricants along with other wastestreams at mining facilities.

Lead/Acid Battery Recycling

The State of Arizona has regulations regarding the disposal of lead batteries. According to Arizona Revised Statute (ARS) §44-1322, the disposal of lead/acid batteries in landfills and the incineration of those batteries is prohibited in the state. The statute requires lead/acid batteries to be sent to a permitted secondary lead smelter, a battery manufacturer or a recycling facility.

Various jurisdictions throughout the state must report the quantity of batteries recycled in the state

to ADEQ. In 1994, 18 jurisdictions reported that 176.47 tons of lead/acid batteries were recycled. This is a low estimate since many jurisdictions fail to report to the state.

National Lead Information Center (NLIC)
• Call the NLIC HOTLINE at:
1-800-LEADFYI to get the pamphlet, Lead Poisoning and Your Children, and other important lead books and brochures, including the NLIC newsletter Lead Inform.

• Call the NLIC CLEARINGHOUSE at:
1-800-424-LEAD for both general and technical assistance on topics such as lead poisoning prevention and proper methods of hazard evaluation and control. They can provide a list of labs that can analyze paint and dust for lead.

Also recently available is the Lead Education Materials Database, which includes information on more than 700 different pieces of lead education and outreach materials. The NLIC can do a search for you or send you the entire database. Documents are available in a wide array of languages.

• See the NLIC on the WWW at: http://www.nsc.org/nsc/ehc/lead.html
This web site summarizes articles that describe successful positive actions taken by individuals, groups and communities to address lead as an environmental and public health hazard.

EPA's Safe Drinking Water Hotline
Call 1-800-426-4791 for information on labs certified to test for lead in water and for filter information.

Occupational Safety and Health Admin. *(OSHA)*
Call 202-219-8151 to get information on respirators and protective clothing for working with lead. The Arizona Industrial Commission (ADOSH) can also provide workplace safety and health assistance at 602-542-5795.

Western Regional Lead Training Center
The center provides training in lead inspection and abatement activities.
15090 Avenue of Science, Suite 103
San Diego, CA 92128
1-800-572-LEAD

Arizona Department of Health Services (ADHS)
Contact the ADHS Office of Environmental Health, Lead Poisoning Prevention Program at 602-230-5943 or 1-800-367-6412. The ADHS can provide information on how to get paint, soil, water and other sources tested for lead.

Consumer Product Safety Commission Hotline
To request information on lead consumer products, or to report an unsafe consumer product or a product related injury call 1-800-638-2772.

The Centers for Disease Control and Prevention National Center for Environmental Health
They have a variety of lead poisoning related information available online including the Blood Lead Laboratory Reference System, surveillance and grant opportunities. The CDC address is:

http://www.cdc.gov/nceh/i:/cehweb/oncehhom.html.

EPA Home Lead Paint Disclosure
Call 1-800-424-5323 for information on real estate lead paint disclosure requirements.

Lead Free Plumbing Fixtures
Call 313-769-8010 for a list of NSF-certified plumbing fixtures.

Community Right-to-Know Hotline
Call the EPCRA hotline at 1-800-535-0202 with questions about the Toxic Chemical Release Inventory Report (Form R).

National Center for Lead-Safe Housing
Develops and promotes cost-effective, practical strategies to make homes lead safe.
205 American Building
Columbia, Maryland 21044
(410) 992-0712

Alliance to End Childhood Lead Poisoning
Supports federal lead poisoning prevention legislation.
227 Massachusetts Avenue, NE, Suite #200
Washington D.C. 20002
(202) 543-1147

Hazardous Waste Complaints in Arizona
For complaints about lead contaminated soil, call the ADEQ Hazardous Waste Section at 602-207-4152.

ADEQ Lead Information Clearinghouse
ADEQ has numerous documents available at the Department's library on lead poisoning and prevention for both industrial and residential settings. Contact the ADEQ librarian at 602-207-2217 or visit the library in person.

ADEQ Pollution Prevention Unit
The Pollution Prevention Unit can provide assistance in identifying specific pollution prevention opportunities for industrial facilities. The unit also offers assistance in completing a Pollution Prevention Plan and the Toxic Chemical Release Inventory Report (Form R).

Partnership for Pollution Prevention (P3)
The Partnership for Pollution Prevention (P3) is a voluntary, non-regulatory industry-government partnership to minimize hazardous waste in Arizona. It provides a means of networking and mutual assistance among participants to implement and promote hazardous waste reduction. The goal of the P3 is to reduce hazardous wastes and to improve communications and cooperation between government and industry. Efforts include sharing information on successful reduction efforts and identifying and resolving impediments to pollution prevention. Partners sign an agreement to put forth a good faith effort and set site-specific goals to minimize hazardous waste.

The P3 formed teams based upon geographical location and types of businesses. The teams are

smaller groups that share process or industry specific information and experiences in pollution prevention. There are currently 9 teams: Aerospace, Automotive, Electronic, Environmental, Phoenix Health Services, Tucson Health Services, Phoenix Industrial, Tucson Industrial, and a Government Team. These teams usually meet monthly and then each quarter the entire P3 meets to discuss a wide range of topics.

Facilities with an interest in joining should contact Peter Shadinger , ADEQ-PPU at 602-207-2346. This would be a good opportunity to ask other facilities about pollution prevention opportunities for lead.

Arizona Emergency Response Commission
The AERC can provide information on the TRI and on Tier II. Contact Dan Roe at 602-231-6346.

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